

**HIGH EFFICIENCY, MONOLITHIC MULTIJUNCTION SOLAR CELLS  
CONTAINING LATTICE-MISMATCHED MATERIALS AND  
METHODS OF FORMING SAME**

**Abstract of the Disclosure**

In one embodiment, a method of forming a multijunction solar cell having lattice mismatched layers and lattice-matched layers comprises growing a top subcell having a first band gap over a growth semiconductor substrate. A middle subcell having a second band gap is grown over the top subcell, and a lower subcell having a third band gap is grown over the middle subcell. The lower subcell is substantially lattice-mismatched with respect to the growth semiconductor substrate. The first band gap of the top subcell is larger than the second band gap of the middle subcell. The second band gap of the middle subcell is larger than the third band gap of the lower subcell. A support substrate is formed over the lower subcell, and the growth semiconductor substrate is removed. In various embodiments, the multijunction solar cell may further comprise additional lower subcells. A parting layer may also be provided between the growth substrate and the top subcell in certain embodiments. Embodiments of this reverse process permit the top and middle subcells to have high performance by having atomic lattice spacing closely matched to that of the growth substrate. Lower subcells can be included with appropriate band gap, but with lattice spacing mismatched to the other subcells. The reduced performance caused by strain resulting from mismatch can be mitigated without reducing the performance of the upper subcells.